STUDY OF DYNAMIC LOADS ON FABRIC CAR COVER USING COUPLED FLUID-STRUCTURAL ANALYSIS

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ABSTRACT –
The efficiency of vehicle aerodynamics has been driven by the strict regulation in terms of CO2 emission reduction and fuel consumption.
Aerodynamics have also a role before the vehicle is delivered to the end user, the transportation of vehicle to local showrooms is done by trucks or train. In order to prevent any damage on the vehicle body due to dust, small stones or hail a textile cover is often applied. The aerodynamic flow unsteadiness is amplified by the cover displacement while at the same time the fabric cover is highly stressed.
In order to extract fabric transient load an understanding of the flow field around the covered car is needed. The problem can be studied using a classical approach of splitting the physics and use a one-way coupling, thus the flow field is calculated first and then it is applied as “frozen” to the structural field where the cover deformations are computed. As an alternative a multiphysics approach can be used, in this case both flow field and structural deformation are solved concurrently. The latter approach goes more insight into the transient dynamics of the phenomena but is much more computational demanding.
ANSA pre-processing tool is used to wrap a deformable car cover around a typical DrivAer, Heft et al. (2012), car body while LS-Dyna multiphysics incompressible fluid solver (ICFD) is used to analyse the coupled fluid and structural phenomena.
An example application has been selected, the fabric cover has been provided by Confezioni Andrea Srl and its permeability experimentally determined.
The methodology presented allows for an evaluation of the dynamic loads acting on the covering fabric and the prediction of fabric resistance to failure due to high frequency and intensity shaking.

REFERNCES
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